Isoxaben

HERBICIDE FACT SHEET

U.S. DEPARTMENT OF ENERGY

BONNEVILLE POWER ADMINISTRATION

This fact sheet is one of a series issued by the Bonneville Power Administration for their workers and the general public. It provides information on forest and land management uses, environmental and human health effects, and safety precautions. A list of definitions is included in Section VIII of this fact sheet.

I. BASIC INFORMATION

COMMON NAME: isoxaben

CHEMICAL NAME: N-[3-(1-ethyl-1-methylpropyl)-5-isoxazoly]-2,6dimethoxybenzamide and isomers

CAS No. 82558-50-7

CHEMICAL TYPE: benzamide family

PESTICIDE CLASSIFICATION: herbicide

REGISTERED USE STATUS: "General Use."

FORMULATIONS: Commercial herbicide products generally contain one or more ingredients. An inert ingredient is anything added to the product other than an active ingredient. Because of concern for human health and the environment, EPA announced its policy on toxic inert ingredients in the *Federal Register* on April 22, 1987 (52FR13305). This policy focuses on the regulation of inert ingredients. EPA's strategy for implementing this policy included the development of four lists of inerts, based on toxicological concerns. Inerts of toxicological concern were placed on List 1. Potentially toxic inerts/high priority for testing were placed on List 2. Inerts of unknown toxicity were placed on List 3, and inerts of minimal concern were placed on List 4.

The inert ingredients of the imazapyr formulations are not classified by the USEPA as inert ingredients of toxicological concerns to humans or the environment.

The contents of the isoxaben formulation are listed below:

Gallery 75 DF®	Isoxaben	75%
	Inert	25%

RESIDUE ANALYTICAL METHODS: Information not available.

II. HERBICIDE USES

REGISTERED FORESTRY, RANGELAND AND RIGHT-OF-WAY USES*:* Industrial sites, utility substations, highways.

OPERATIONAL DETAILS:

TARGET PLANTS: Isoxaben is used for pre-emergence control of certain broadleaf weeds in non-cropland areas. Does not control established weeds.

MODE OF ACTION: Isoxaben inhibits cell wall biosynthesis. Susceptible plants are killed prior to emergence.

METHOD OF APPLICATION: Isoxaben, a pre-emergence herbicide, is applied during planting and in established turf grasses/ open areas at an application rate of 0.66 to 1.66 pounds per acre.

SPECIAL PRECAUTIONS:

TIMING OF APPLICATION: Isoxaben, a pre-emergent weed herbicide, is applied during germination of the target plant. Isoxaben is also registered for use in established turf grasses to prevent growth of unwanted weeds.

DRIFT CONTROL: Isoxaben is mixed with water and applied using low-pressure sprayers. Isoxaben can be applied to dry soil, as water does not affect the effectiveness of the herbicide. Care should be exercised not to overspray or apply the herbicide to adjacent non-target areas.

III. ENVIRONMENTAL EFFECTS/FATE

SOIL:

RESIDUAL SOIL ACTIVITY: Isoxaben residual activity is reported not to exceed 6 months under normal application rates.

ADSORPTION: Isoxaben has a K(oc) of 1400 and is moderately adsorbed onto soils.

PERSISTENCE AND AGENTS OF DEGRADATION: The half-life of isoxaben in the soil is 100 days.

METABOLITES/DEGRADATION PRODUCTS AND POTENTIAL ENVIRONMENTAL EFFECTS: Information not available.

WATER:

SOLUBILITY: Less than 1.0 mg/l water.

POTENTIAL FOR LEACHING INTO SURFACE OR GROUND WATER: There is a low potential for leaching into surface and groundwater.

AIR:

VOLATILIZATION: Isoxaben is slightly volatile at $<3.9 \times 10^{-7}$ mm Hg at 77° F.

POTENTIAL FOR BYPRODUCTS FROM BURNING OF TREATED VEGETATION: Information is not available; however, the formulated product will emit toxic vapors as it burns.

IV. ECOLOGICAL TOXICITY EFFECTS ON NON-TARGET SPECIES

MICROORGANISMS:

ACUTE CONTACT TOXICITY: LD_{50} (honey bee contact) >100 µg/bee

OVERALL TOXICITY: Practically Non-Toxic

PLANTS: Contact will injure or kill target and non-target plants.

AQUATIC VERTEBRATES:

ACUTE TOXICITY: LC_{50} (rainbow trout 96-hour) 1.1 mg/l

ACUTE TOXICITY: LC_{50} (bluegill sunfish 96-hour) 1.1 mg/l

OVERALL TOXICITY: Moderately Toxic

AQUATIC FRESHWATER INVERTEBRATES:

ACUTE TOXICITY: LC_{50} (*Daphnia magna* 48-hour) >100 mg/l

OVERALL TOXICITY: Practically Non-Toxic

AQUATIC ESTUARINE/MARINE INVERTEBRATES:

ACUTE TOXICITY: LC_{50} (sheepshead minnow 96-hour)

ACUTE TOXICITY: LC_{50} (grass shrimp 96-hour)

ACUTE TOXICITY: LC_{50} (eastern oyster 96-hour)

OVERALL TOXICITY: Practically Non-Toxic (Based on freshwater data, imazapyr is not expected to be toxic to estuarine invertebrates.)

TERRESTRIAL ANIMALS:

AVIAN ACUTE ORAL TOXICITY: LD_{50} (bobwhite quail)

AVIAN ACUTE ORAL TOXICITY: LD_{50} (mallard duck)

AVIAN SUBACUTE DIETARY TOXICITY: LC_{50} (bobwhite quail) >5000 mg/kg

AVIAN SUBACUTE DIETARY TOXICITY: LC_{50} (mallard duck) >5000 mg/kg

MAMMAL ACUTE ORAL TOXICITY: LD_{50} (rat) >5000 mg/kg

OVERALL TOXICITY: Practically Non-Toxic

BIOACCUMULATION POTENTIAL: Little Potential

THREATENED AND ENDANGERED SPECIES: Isoxaben may be a hazard if applied to pre-emerging endangered plants and if applied directly to waters containing endangered aquatic plant life. There is an indication that isoxaben may interfere with reproduction and may cause birth defects in animals.

V. TOXICOLOGICAL DATA

ACUTE TOXICITY:

ACUTE ORAL TOXICITY: LD_{50} (rat) >5000 mg/kg

ACUTE DERMAL TOXICITY: LD_{50} (rabbit) >2000 mg/kg

PRIMARY IRRITATION SCORE: Slight

PRIMARY EYE IRRITATION: Moderate. The formulated product may cause moderate eye irritation, which may be slow to heal. May cause slight temporary corneal injury.

ACUTE INHALATION: LC_{50} (rat) >2.68 mg/l

OVERALL TOXICITY: Category III – Caution – Slightly Toxic

CHRONIC TOXICITY:

CARCINOGENICITY: Isoxaben is considered slightly oncogenic. In addition, the formulated product contains crystalline silica (in kaolin), which is listed as a known carcinogen.

DEVELOPMENTAL: Unknown effects.

REPRODUCTIVE: Has been shown to interfere with reproduction in animals.

MUTAGENICITY: Isoxaben has caused birth defects in laboratory animals at doses toxic to the mother.

HAZARD: Based on the results of animal studies, isoxaben causes genetic damage and birth defects. There are data that support the finding that isoxaben has potential to have cancer-causing effects on animals.

VI. HUMAN HEALTH EFFECTS

ACUTE TOXICITY (POISONING):

REPORTED EFFECTS: None reported.

CHRONIC TOXICITY:

REPORTED EFFECTS: None reported.

POTENTIAL FOR ADVERSE HEALTH EFFECTS FROM CONTACTING OR CONSUMING TREATED VEGETATION, WATER OR ANIMALS: None reported.

POTENTIAL FOR ADVERSE HEALTH EFFECTS FROM INERT INGREDIENTS CONTAINED IN THE FORMULATED PRODUCTS: Slight skin and eye irritation caused by clay (Kaolin) binding agents. Crystalline silica (in Kaolin) is listed as a carcinogen for hazard communication purposes under 29 CFR 1910.1200.

HEALTH EFFECTS OF EXPOSURE TO FORMULATED PRODUCTS: There have been no reported effects on workers manufacturing the products.

HEALTH EFFECTS ASSOCIATED WITH CONTAMINANTS: None reported.
HEALTH EFFECTS ASSOCIATED WITH OTHER FORMULATIONS: None reported.
HEALTH RISK MANAGEMENT PROCEDURES: See Section VII.

VII. SAFETY PRECAUTIONS

SIGNAL WORD AND DEFINITION:

ISOXABEN - **CAUTION** – CAUSES EYE IRRITATION AND HARMFUL IF INHALED.

PROTECTIVE PRECAUTIONS FOR WORKERS: Use safety glasses. Use impervious gloves when prolonged or frequently repeated contact could occur. In enclosed spaces, use NIOSH-approved dust respirator. Long-sleeved shirt, long pants, shoes, and socks are required for workers.

MEDICAL TREATMENT PROCEDURES (ANTIDOTES):

EYES: Flush eyes with water; call physician if irritation develops.

SKIN: Wash all exposed areas with soap and water. Wash all contaminated clothing prior to reuse. Call a physician if irritation develops.

INGESTION: Call a physician or Poison Control Center. Immediately transport to a medical care facility.

INHALATION: Remove individual to fresh air. If breathing difficulty occurs, provide CPR assistance and seek immediate medical attention.

HANDLING, STORAGE AND DISPOSAL: Keep dry (below 120° F) and store away from food, feed, or other material to be used or consumed by humans or animals. Do not contaminate water. Dispose only in accordance with local, state and federal regulations.

EMERGENCY SPILL PROCEDURES AND HAZARDS: Contain and sweep up material of small spills and dispose as waste. Large spills should be reported to CHEMTREC (800-424-9300) for assistance. Prevent runoff. Do not contaminate water, food or feed by storage or disposal.

VIII. DEFINITIONS

adsorption – the process of attaching to a surface

avian – of, or related to, birds

CAEPA – California Environmental Protection Agency

carcinogenicity – ability to cause cancer

CHEMTREC – Chemical Transportation Emergency Center

dermal – of, or related to, the skin

EC_{50} - median effective concentration during a bioassay

ecotoxicological – related to the effects of environmental toxicants on populations of organisms originating, being produced, growing or living naturally in a particular region or environment

FIFRA – Federal Insecticide, Fungicide and Rodenticide Act

formulation – the form in which the pesticide is supplied by the manufacturer for use

half-life – the time required for half the amount of a substance to be reduced by natural processes

herbicide – a substance used to destroy plants or to slow down their growth

Hg – chemical symbol for mercury

IARC – International Agency for Research on Cancer

K(oc) – the tendency of a chemical to be adsorbed by soil, expressed as: K(oc) = conc. adsorbed/conc. dissolved/% organic carbon in soil

LC_{50} – the concentration in air, water, or food that will kill approximately 50% of the subjects

LD_{50} – the dose that will kill approximately 50% of the subjects

leach – to dissolve out by the action of water

mg/kg – weight ratio expressed as milligrams per kilogram

mg/l – weight-to-liquid ratio expressed as milligrams per liter

microorganisms – living things too small to be seen without a microscope

mPa – milli-Pascal (unit of pressure)

mutagenicity – ability to cause genetic changes

NFPA – National Fire Protection Association

NIOSH - National Institute for Occupational Safety and Health

NOEL - no observable effect level

non-target – animals or plants other than the ones that the pesticide is intended to kill or control

OSHA - Occupational Safety and Health Administration

Pa – Pascal (unit of pressure)

persistence – tendency of a pesticide to remain to remain in the environment after it is applied

pesticides – substances including herbicides, insecticides, rodenticides, fumigants, repellents, growth regulators, etc., regulated under FIFRA

PPE – personal protective equipment

ppm – weight ratio expressed as parts per million

residual activity – the remaining amount of activity as a pesticide

T&E – Threatened and Endangered Species (from the Endangered Species Act)

µg – micrograms

volatility – the tendency to become a vapor at standard temperatures and pressures

IX. INFORMATION SOURCES

Dow AgroSciences, Gallery 75® Dry Flowable (DF) Product Label, EPA RN 62719-145, Label Code D02-081-008, October 1993, Revised January 1, 1998.

Dow AgroSciences, Gallery 75® DF Material Safety Data Sheet No. 003994, October 6, 1998.

DowElanco (Dow AgroSciences), Isoxaben Technology Transfer Resource Guide, January 1997.

EPRI, Determination of the Effectiveness of Herbicide Buffer Zones in Protecting Water Quality, EPRI Final Report TR-113160, 1999

Extension Toxicology Network, Toxicology Information Briefs: Bioaccumulation, Revised 1993, http://ace.orst.edu/info/extoxnet/tibs/bioaccum.htm

New York State, Department of Environmental Conservation, Letter to DowElanco (now Dow AgroSciences) Denying Applications to Register…Gallery 75® Dry Flowable…, with reasons, dated February 11, 1994.

Oregon State University, et al., Pacific Northwest Weed Control Handbook, 1998.

Spray Drift Task Force, A Summary of Ground Application Studies, 1997 http://www.agdrift.com/publications/Body.htm

Thomson, W.T., Agricultural Chemicals, Book II Herbicides, 1989.

Weed Science Society of America, Herbicide Handbook, 6th Edition, 1989.

X. TOXICITY CATEGORY TABLES

TABLE I: HUMAN HAZARDS

Category	Signal Word	Route of Administration			Hazard	
		Acute Oral LD_{50} (mg/kg)	Acute Dermal LD_{50} (mg/kg)	Acute Inhalation LC_{50} (mg/l)	Eye irritation	Skin irritation
I (Highly Toxic)	**DANGER (poison)**	0–50	0-200	0-0.2	corrosive: corneal opacity not reversible within 7 days	corrosive
II (Moderately Toxic)	**WARNING**	>50–500	>200-2000	>0.2-2	corneal opacity reversible within 7 days; irritation persisting for 7 days	severe irritation at 72 hours
III (Slightly Toxic)	**CAUTION**	>500-5000	>2000-20.000	>2-20	no corneal opacity; irritation reversible within 7 days	moderate irritation at 72 hours
IV (Practically Non-toxic)	**NONE**	>5000	>20,000	>20	no irritation	moderate irritation at 72 hours

After *Pesticide User's Guide*, Ohio State University, Extension Bull. No. 745, 1998.

TABLE II: ECOTOXICOLOGICAL RISKS TO WILDLIFE (TERRESTRIAL AND AQUATIC)

Risk Category	Mammals (Acute Oral LD_{50} mg/kg)	Avian (Acute Oral LD_{50} mg/kg)	Avian LC_{50} (mg/kg)	Fish or Aquatic Invertebrates LC_{50} (mg/l)
Very Highly Toxic	<10	<10	<50	<0.1
Highly Toxic	10-50	10-50	50-500	0.1 – 1
Moderately Toxic	51-500	51-500	501-1,000	>1 – 10
Slightly Toxic	501-2,000	501-2,000	1,001-5,000	>10 – 100
Practically Non-toxic	>2,000	>2,000	>5,000	>100

Table II created from information contained in *Pesticides and Wildlife*, Whitford, Fred, et al., Purdue University Cooperative Extension Service PPP-30, 1998.

Disclaimers and Other Legal Information:

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